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<p>(21) International Application Number: PCT/GB91/00015 (22) International Filing Date: 4 January 1991 (04.01.91) (30) Priority data: 9000481.3 9 January 1990 (09.01.90) GB (71) Applicant (for all designated States except US): SAX-TECH LIMITED [GB/GB]; Falcon House, The Harlequin Centre, Southall Lane, Southall, Middlesex UB2 5NH (GB). (72) Inventor; and (75) Inventor/Applicant (for US only): SEYMOUR, Robert, John [GB/GB]; 63 Bunbury Way, Epsom Downs, Epsom, Surrey KT17 4JP (GB). (74) Agent: CROUCH, David, John; Bromhead & Co., 19 Buckingham Street, London WC2N 6EF (GB).</p>		<p>(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US. Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p> <p style="text-align: right;"><i>C. J. 10</i></p>
<p>(54) Title: SHOES</p> <div data-bbox="446 1092 1485 1627"> </div> <p>(57) Abstract</p> <p>A shoe (10), especially but not exclusively a sports or leisure shoe, having at least one fluid-containing cavity (24 or 30) in its sole (12). At least one duct (20 or 22) extends from the said at least one cavity, so that an increase in pressure within that cavity (24 or 30) when the shoe (10) is in use, owing to a force applied by the foot of the wearer, is transferred to a part of the shoe (10) other than the part thereof to which the said force is applied.</p>		

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Shoes

The present invention relates to shoes, especially but not exclusively sports or leisure shoes.

5 Sports shoes, commonly known as trainers, have hitherto been made with fluid-filled sacs embedded into their soles, to reduce the likelihood of injury of the wearer's foot and/or leg. However, it has been found that the extent of protection afforded by such a sac is limited
10 to a cushioning effect.

The present invention seeks to improve the extent to which a foot is protected by a shoe.

Accordingly, the present invention is directed to a shoe having at least one fluid-containing cavity in
15 its sole, characterised in that at least one duct extends from the said at least one cavity so that an increase in pressure within that cavity when the shoe is in use, owing to a force applied by the foot of the wearer, is transferred to a part of the shoe other than the part
20 thereof to which the said force is applied.

Preferably, the said at least one duct extends to and is secured to a part of the shoe upper, so as to stiffen that part and reduce any tendency of the foot to roll or pronate when it is planted on the ground, whilst
25 at the same time leaving the shoe upper relatively supple when such a force is not applied. For example, the or each duct may be secured to the heel of the shoe upper.

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Alternatively it may be secured to one or more side walls of the shoe upper.

The or each duct may be tubular and it may be elastomeric.

5 In one embodiment of the present invention, the said at least one duct extends from one portion of the cavity to another portion of that cavity. Alternatively, it may extend to another cavity. It may be curved between its two ends to form a loop. Furthermore, one
10 end may be provided with a non-return valve so that fluid from the cavity may only flow through the duct in one direction. Advantageously, the favoured direction of the non-return valve is towards the cavity, away from the duct.

15 In another embodiment of the present invention, two fluid-containing cavities are provided in the sole of the shoe, the two cavities being connected by the said at least one duct. The latter may be contained within the sole of the shoe, or it may be arranged so as to be
20 visible from outside the shoe.

To provide a visual effect, the ducting may be visible from outside of the shoe and it may be made of a transparent or otherwise translucent material, the fluid being coloured or otherwise visually detectable.

25 Thus the present invention extends to a shoe having at least one fluid-containing cavity in its sole, characterised in that at least one transparent or

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otherwise translucent duct extends from the said at least one cavity to an external part of the shoe so that when a force is applied by a foot of the wearer to that cavity, fluid is transferred therefrom to the said at least one
5 duct, to be visible from outside the shoe.

In this form of the present invention, the fluid may be coloured to give a particularly vivid visual impression.

Preferably, the said at least one duct extends
10 to and is secured to a part of the shoe upper. Thus, the said at least one duct may be secured to the heel of the shoe upper. Alternatively it may be secured to one or more side walls of the shoe upper.

The duct may be tubular and it may be
15 elastomeric.

An example of a shoe made in accordance with the present invention is illustrated in the accompanying drawings, in which :

Figure 1 shows a side elevational view of the
20 shoe;

Figure 2 shows a perspective view of some of the rear components of the shoe shown in Figure 1;

Figure 3 shows a perspective view of some of the forward components of the shoe shown in Figure 1;

25 Figure 4 is a perspective exploded view showing how the components shown in Figures 2 and 3 are assembled in a sole of the shoe shown in Figure 1;

Figure 5 shows, on a larger scale, a perspective view of one of the components of the shoe shown in Figure 1;

Figure 6 shows a perspective view of a modified form of the component shown in Figure 5; and

Figure 7 shows a rear perspective view of a modified form of the shoe shown in Figure 1.

The shoe shown in Figure 1 is a sports shoe or trainer 10 comprising a moulded plastics sole 12, a shoe upper 13, a toe rim 14, a heel counter 16 and two forward counters 18 (only one of which is visible in Figure 1).

Elastomeric synthetic polymer material tubular looped ducts 20 extend along and are recessed in grooves or channels 21 moulded in the outside of the heel counter 16. Similar looped ducts 22 (only one of which is visible in Figure 1) are recessed in grooves or channels 23 formed in the forward counters 18.

Figure 2 shows a plastics or elastomeric synthetic polymer material moulded sac 24 shaped to conform to the heel of the shoe and having a pair of outwardly projecting portions 26 on each side thereof. This sac 24 contains a coloured gel (not shown, for the sake of clarity). Tubular plastics connector elements 28 extend respectively into the projecting portions 26, their interiors being in communication with the interior of the sac 24. Respective ends of the tubular ducts 20 are attached to the connectors 28 to form two looped ducts

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each having their interiors in communication with the interior of the sac 24. A non-return ball valve 44 is provided at one end only of each of the looped ducts 20 so as to allow fluid to pass through those valves into the interior of the sac 24, away from the ducts 20, but not in the other direction.

The sac 24, the connectors 28 and the tubular ducts 20 may be fused together by bonding or welding to effect attachment to one another, and create a hermetically sealed unit, barring only means (not shown) to pressurise the unit with the coloured gel.

Figure 3 shows a forward sac 30 with connectors 34, tubular ducts 22 and non-return valves 46 constructed in substantially the same manner as the components shown in Figure 2, but with the sac 30 being of elongate shape to extend across a forward part of the sole where the ball of the foot presses, and the tubular ducts 22 each extending from a forward portion of the sac to a rearward portion thereof, on the same side thereof as opposed to the Figure 2 construction in which each looped duct 20 extends from one side of the sac 24 to the other side thereof.

Figure 4 shows the sole 12 of the shoe shown in Figure 1 in greater detail, with recesses 36 and 38 to which the sacs 24 and 30 conform respectively, slots 40 and 42 being provided at the sides of the sole 12 to accommodate the connectors 28 and 34. It will be

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appreciated that the recesses 36 and 38, and the slots 40 and 42, may be in-moulded into the sole 12 at the time of manufacture thereof. During assembly of the shoe the sacs 24 and 30 are inserted in to the recesses 36 and 38 of the sole 12, the heel counter 16 and the forward counters 18 are then inserted in such a manner with the tubular ducts 20 and 22 are recessed in the channels 21 and 23 respectively, and then the remainder of the shoe upper is assembled to complete the shoe shown in Figure 1. The parts concerned may be stitched or welded together, as appropriate.

Figure 5 shows in greater detail the construction of the ball valve 44 or 46. Thus it comprises a ball 47 contained in a valve body which has an annular seating 48 which is cup-shaped to conform to the radius of the curvature of the ball 47, a circular hole 50 defined within the annular seating 48, and four flared legs 52 extending away from the seating 48. All these parts of the valve may be made of a moulded synthetic plastics material. The legs 52 are splayed outwardly at the time of manufacture of the ball valve so that when the valve seating is inserted in to the interior of one end of a tubular duct 20, for example, with the ball 54 positioned in the valve body interior, as the valve body is inserted in to the tube 20, the ends of the legs 52 are urged towards one another to trap the ball 54 in the valve body. It will thus be appreciated that fluid endeavouring

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to flow in the direction from the legs 52 to the seating 48 will be prevented as the ball 47 is trapped against the seating 48 to close the aperture 50, whereas fluid will be free to flow in the other direction since the ball 47 is
5 then urged away from the seating 48.

In the modified construction of non-return valve shown in Figure 6, a hollow cylindrical portion 58 is provided having an external diameter substantially the same as the interior diameter of the tubular duct 20, so
10 as to form a tight fit therein, and a flange 36 at one end to which is secured a flap 62 via a thin portion of plastics material 64 which forms a hinge between the flap 62 and the flange 60 and which is resilient in such a manner as to urge the flap 62 weakly towards the flange
15 60. As a result, when fluid flows in the direction from the cylindrical portion 58 to the flap 62, the latter is urged away from the flange 60 and fluid continues to flow freely, whereas fluid endeavouring to flow in the other direction will simply urge the flap 62 against the flange
20 60 to close the valve. It will be appreciated that this modified construction of valve requires a connector 28 which extends around the outside of the tubular duct end.

The construction of shoe shown in Figures 1 to 5 results in any pressure exerted on the heel of the shoe or
25 where the ball of the foot meets the shoe, during activity by the wearer, increasing the pressure of the fluid contained in the associated sac, and this pressure is

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transmitted in to the tubular ducts 20 or 22 so as to increase support provided for the foot by the shell of the shoe, and reduce the likelihood of the foot rolling as well as cushioning the foot against impact on the ground.

5 This improves the protection the shoe affords to the wearer's foot, ankle and leg.

The presence of the valves 44 and 46 enables the whole of each looped duct 20 and 22 to be filled with the gel which is contained in the sacs 24 and 30, thus

10 ensuring that a bubble of air, for example, is not trapped in the upper portion of each loop. The result is a visually striking pulsing effect as the gel shoots into the ducts and then out of the ducts, back into the sacs, when the pressure thereon is removed.

15 Alternatively or in addition, the fact that the gel is coloured and the tubular ducts 20 and 22 are transparent or otherwise translucent affords a striking visual image of gel shooting into the ducts 20 and 22 as the wearer moves.

20 Numerous modifications and variations to the illustrated shoe will readily occur to a person familiar with the art of shoemaking without taking the shoe outside the scope of the present invention. For example, where the sac 24 is filled wholly or in part with a gaseous

25 material, such as air, it may be provided at its rear with a non-return valve 66 as shown in Figure 7 to which may be connected a bulb pump 68 to increase or vary the pressure

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within the sac 24 for different sports activities, for example for playing squash, where a higher degree of resilience of the sac 24 may be called for, and an increased resistance to pronation.

5 Instead of sacs 24 and 30, the heel 12 may be otherwise provided with cavities by being formed or otherwise injected with a fluid to create voids in the regions occupied by those sacs in the shoe shown in Figures 1 to 5.

10 Instead of externally arranged ducts 20 and 22, one or more internal ducts may connect the two sacs. The latter may be modified and arranged side-by-side instead of being spaced in the longitudinal direction of the shoe, and connected by ducts visible from outside the shoe.

15 This would facilitate a banking effect for the wearer.

The fluid used to fill the sacs may be less viscous than a gel, so it may be a coloured liquid.

Instead of a non-return valve, the end of each duct may be provided with a simple constriction, so that

20 the gel will take the path of least resistance and an air bubble in the centre of the duct is unlikely to be formed even with such a less expensive construction.

It will be appreciated that the pressure transferred to the ducts is progressive, in the sense that

25 the higher the load on a sac, the higher the pressure within the associated ducts. Similarly, a lowering or removal of the load on a sac results in a corresponding lowering or absence of pressure in th associated ducts.

Claims

1. A shoe having at least one fluid-containing cavity in its sole, characterised in that at least one
5 duct extends from the said at least one cavity so that an increase in pressure within that cavity when the shoe is in use, owing to a force applied by the foot of the wearer, is transferred to a part of the shoe other than the part thereof to which the said force is applied.
- 10 2. A shoe according to claim 1, characterised in that the said at least one duct extends to and is secured to a part of the shoe upper, so as to stiffen that part and reduce any tendency of the foot to roll or pronate when it is planted on the ground.
- 15 3. A shoe according to claim 2, characterised in that the or each duct is secured to the heel of the shoe upper.
4. A shoe according to claim 2, characterised in that the or each duct is secured to one or more side walls
20 of the shoe upper.
5. A shoe according to any preceding claim, characterised in that the or each duct is tubular.
6. A shoe according to any preceding claim, characterised in that the or each duct is made of an
25 elastomeric material.
7. A shoe according to any preceding claim, characterised in that the said at least one duct extends

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from one portion of the said at least one cavity to another portion of that cavity.

8. A shoe according to any preceding claim, characterised in that the said at least one duct extends
5 to another cavity of the shoe.

9. A shoe according to any preceding claim, characterised in that the said at least one duct is curved between its two ends to form a loop.

10. A shoe according to any preceding claim,
10 characterised in that one end of the said at least one duct is provided with a non-return valve so that fluid from the said at least one cavity may only flow through the duct in one direction.

11. A shoe according to claim 10, characterised in
15 that the favoured direction of the non-return valve is towards the cavity, away from the duct.

12. A shoe according to any preceding claim, characterised in that two fluid-containing cavities are provided in the sole of the shoe, the two cavities being
20 connected by the said at least one duct.

13. A shoe according to any preceding claim, characterised in that the said at least one duct is contained within the sole of the shoe.

14. A shoe according to any one of claims 1 to 12,
25 characterised in that the said at least one duct is arranged so as to be visible from outside the shoe.

15. A shoe according to any preceding claim,

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characterised in that to provide a visual effect, the or each duct is visible from outside of the shoe and in that it is made of a transparent or otherwise translucent material, the fluid being coloured or otherwise visually
5 detectable.

16. A shoe having at least one fluid-containing cavity in its sole, characterised in that at least one transparent or otherwise translucent duct extends from the said at least one cavity to an external part of the shoe
10 so that when a force is applied by a foot of the wearer to that cavity, fluid is transferred therefrom to the said at least one duct, to be visible from outside the shoe.

17. A shoe according to claim 16, characterised in that the fluid is coloured.

15 18. A shoe according to claim 16 or claim 17, characterised in that the said at least one duct extends to and is secured to a part of the shoe upper.

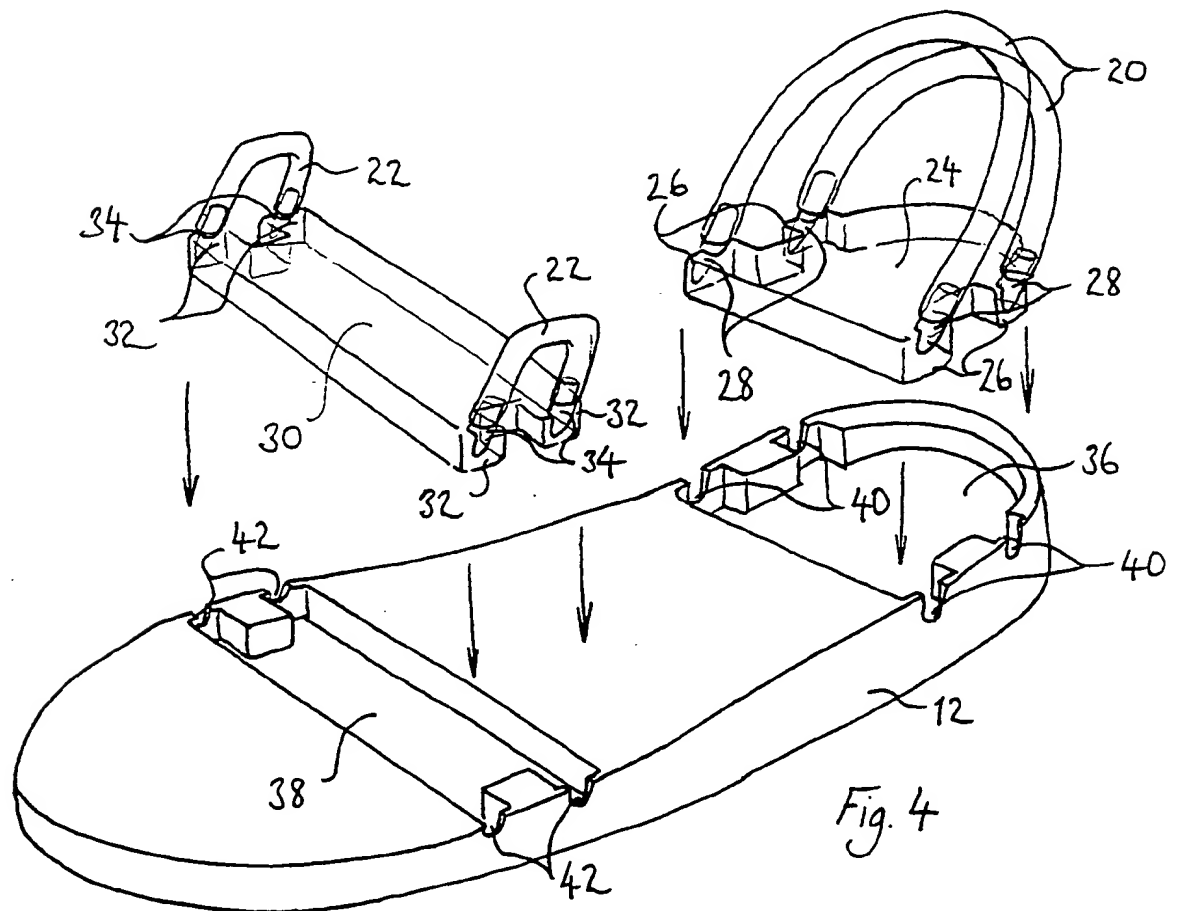
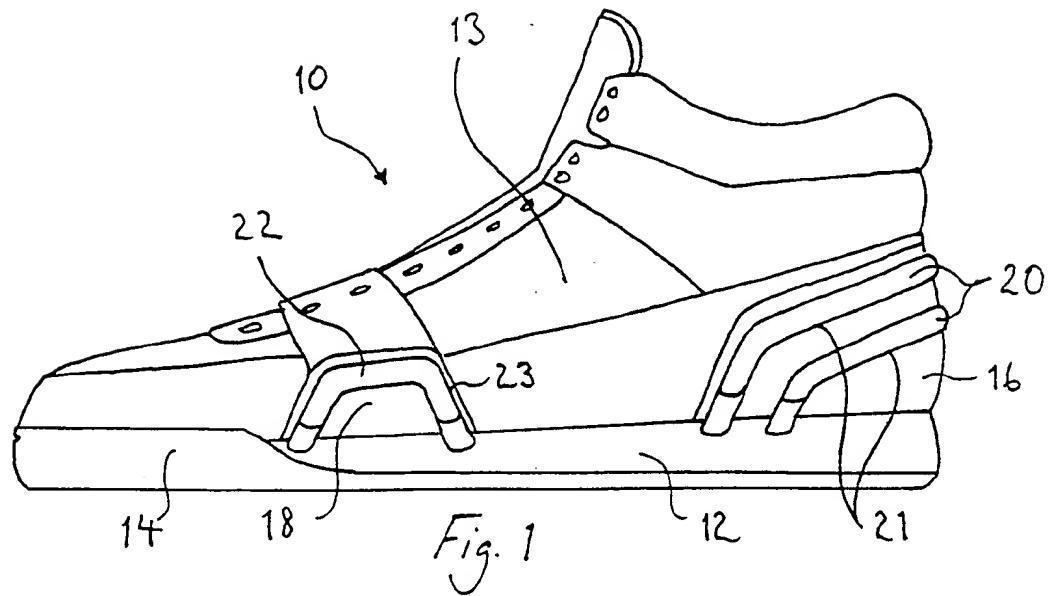
19. A shoe according to claim 18, characterised in that the said at least one duct is secured to the heel of
20 the shoe upper

20. A shoe according to claim 18, characterised in that the said at least one duct is secured to one or more side walls of the shoe upper.

21. A shoe according to any one of claims 16 to 20,
25 characterised in that the said at least one duct is tubular.

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22. A shoe according to any one of claims 16 to 21, characterised in that the said at least one duct is made of an elastomeric material.



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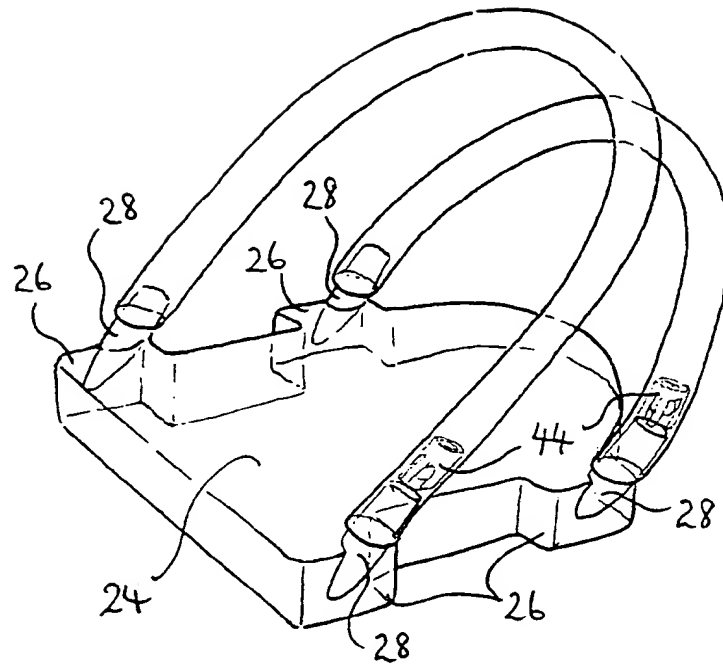


Fig. 2

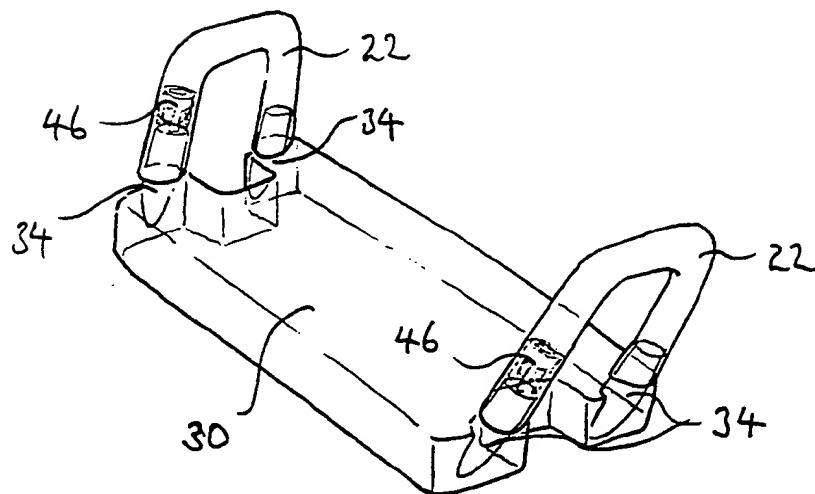
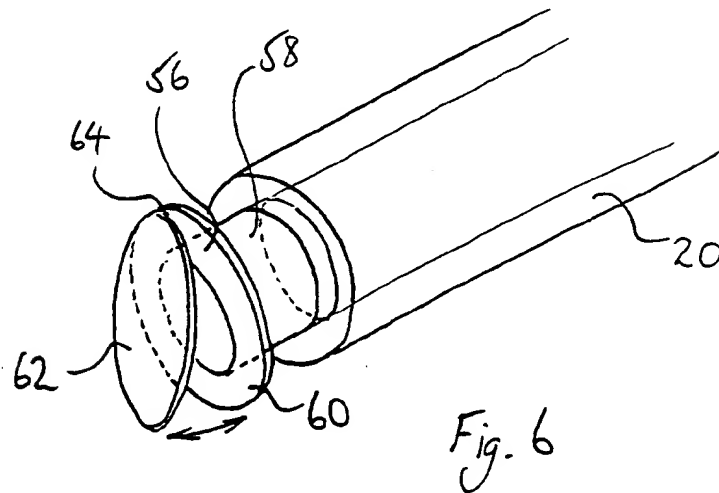
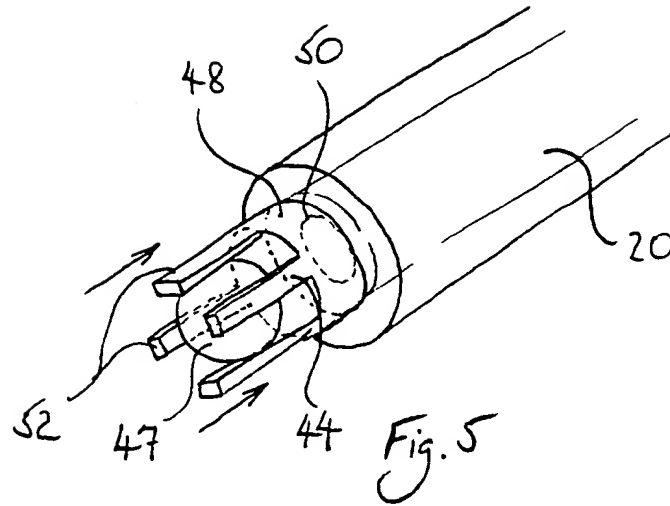


Fig. 3

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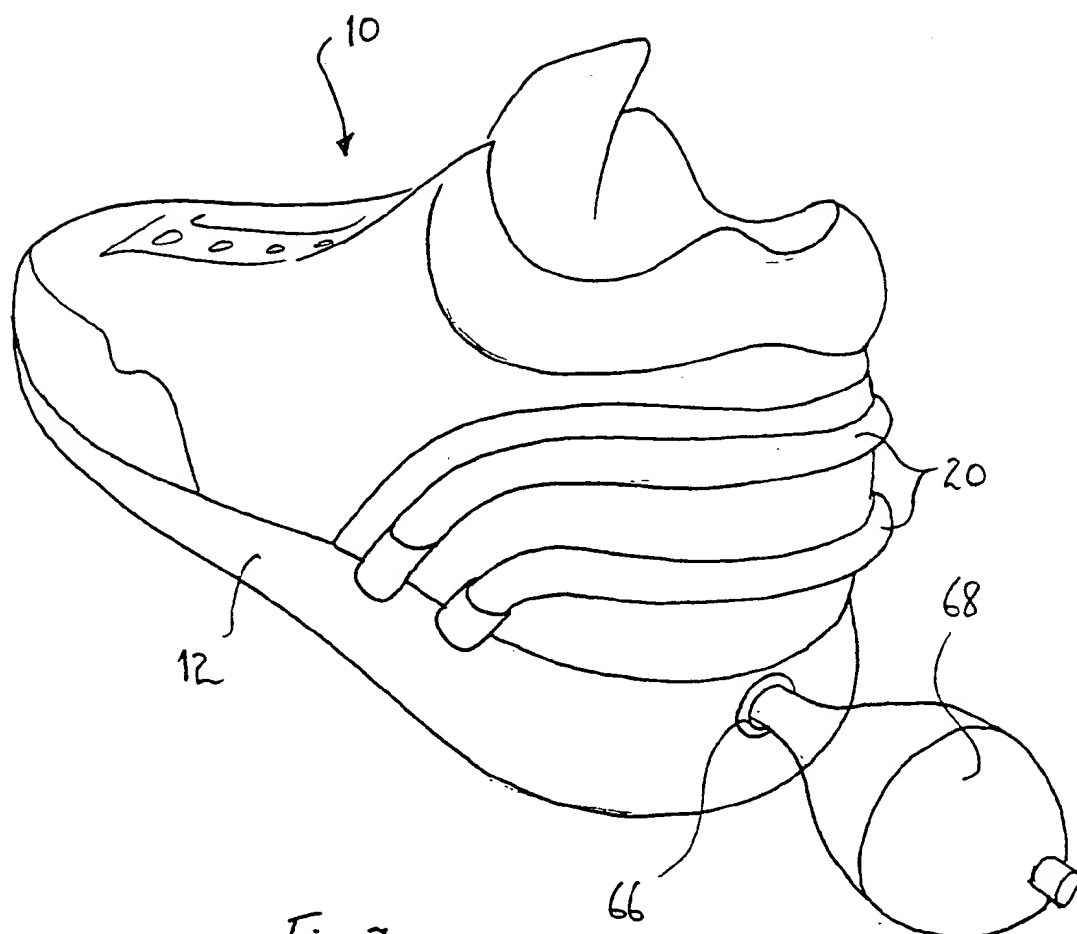


Fig. 7

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 91/00015

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁴

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC⁵: A 43 B 13/20

II. FIELDS SEARCHED

Minimum Documentation Searched ⁷

Classification System

Classification Symbols

IPC⁵

A 43 B

Documentation Searched other than Minimum Documentation
to the extent that such Documents are included in the Fields Searched ⁸

III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹

Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	WO, A, 89/10074 (M. SADLER) 2 November 1989	1, 16-22
A	--	2-6
X	GB, A, 2114425 (CLARKS) 24 August 1983	1, 8, 10-13
X	GB, A, 2073006 (ENERGY SHOE) 14 October 1981	1, 8
X	EP, A, 0062622 (L. PETERSON) 13 October 1982	1, 8, 12, 13
X	US, A, 4446634 (P. JOHNSON) 8 May 1984	1

¹⁰ Special categories of cited documents: ¹⁰

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IV. CERTIFICATION

Date of the Actual Completion of the International Search

16th April 1991

Date of Mailing of this International Search Report

17. 06. 91

International Searching Authority

EUROPEAN PATENT OFFICE

Signature of Authorized Officer

[Signature] Nuria TORIBIO

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

GB 9100015
SA 43645

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 07/05/91. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A- 8910074	02-11-89	AU-A- 3358889	24-11-89
GB-A- 2114425	24-08-83	None	
GB-A- 2073006	14-10-81	US-A- 4358902	16-11-82
		CA-A- 1143938	05-04-83
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		SE-A- 8102124	03-10-82
		US-A- 4458430	10-07-84
US-A- 4446634	08-05-84	None	

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